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Dredged Material Management Categories for Tracking Beneficial Use

by John L. Childs

PURPOSE: Sediment dredged for navigation projects are relocated for either: (1) disposal; or (2) beneficial use. The volume of sediment dredged from navigation projects is quantified at the project level. The U.S. Army Corps of Engineers (USACE) Navigation Data Center (NDC) compiles the project level information and prepares statistics at the Corps-wide level. The NDC maintains information on type of dredge plant, volume of sediments dredged, cost, and “type of material disposal.” The category “type of material disposal” does not discern between disposal and beneficial use; therefore, the volume of sediment used for beneficial use is not known with certainty.

The purpose of this technical note is to present twelve categories to be used universally for tracking dredged material management that will allow for quantification of sediment that is managed for disposal, as well as beneficial use. These categories were vetted through a survey to USACE Division Navigation Managers, as well as several District Navigation Managers. A secondary purpose of this technical note is to provide an estimate of the sediment relocated for beneficial use during navigation projects. Although the NDC does not differentiate disposal and beneficial use, the database is currently the most comprehensive information available regarding dredged material management; and, with professional judgment, an estimate is achievable, albeit the range of the estimate is large.

Consistent dredged material management terminology is an integral step toward the dredging industry being credited for environmental and social benefits created due to relocation of sediment during navigational dredging projects. Accurate tracking of navigational dredged material will also enable scientists and resource managers to gain an improved understanding of Regional Sediment Management (RSM) actions or opportunities to improve the use of sediments. Understanding the volume of dredged material relocated within the littoral system compared with the volume removed from the littoral system is a critical component of RSM within a watershed system. The dredged material management categories presented distinguishes between discharge below the littoral system, within the littoral system, and above the littoral system.

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PROBLEM STATEMENT: There are approximately 25,000 miles of inland and intracoastal navigable waterways that operate like highways to move waterborne commerce within the United States. Approximately 11,000 of these miles are commercially important and are maintained by the USACE to ensure safe, reliable, efficient, and environmentally sustainable movement of vessels (USACE 2011). The USACE Navigation Dredging Center, which is

managed by the USACE Institute for Water Resources (IWR), gathers information on dredging and dredged material management and prepares statistics for the United States. These statistics indicate that an annual average of 220 million cubic yards (cy) of dredged material were excavated and managed in ocean, coastal, and inland sites between 1995 and 2011 to maintain and create the inland, coastal, and intra-coastal waterways (USACE 2012a). An additional volume of material, approximately 75 million cubic yards, is dredged annually by Ports, private contractors, and other federal and non-federal entities. This annual volume of approximately 300 million cubic yards would cover 100 square miles (64,000 acres) with nearly 3 feet of dredged material; or fill approximately 20 million standard dump trucks, which would stretch approximately 90,000 miles from end to end.

Much of the material dredged for navigation is natural sediment in U.S. waterways (World Association for Waterborne Transport Infrastructure (PIANC 2009). Programs such as the USACE Regional Sediment Management (RSM) Program (USACE 2012b) identify sediment as a resource (<http://rsm.usace.army.mil/>) and promote sustainable practices through planning, engineering, construction, and operation and maintenance of existing Federal projects on a regional or watershed basis. The American Society of Civil Engineers (ASCE) recognizes sediment as a resource and supports regional sediment management for watershed and coastal zones to ensure ecosystem preservation and sustainable development (ASCE Policy Statement 522 ASCE 2010). ASCE Policy Statement 522 states, “Regional sediment management is critical to restoring hydrogeomorphic processes within a watershed, which in turn is important to ecosystem vitality, balance and diversity, particularly in threatened ecosystems such as the Mississippi Delta or the South Florida wetlands” (<http://www.asce.org/Content.aspx?id=8638>). Furthermore, beneficial use of dredged material (sediment) is a priority for the USACE (Landin 1988). Because navigational dredged material is nearly 100% sediment (sand, silt, clay, and water), dredged material can also be referred to as “dredged sediments.” In this technical note, the terms dredged material and dredged sediment are used interchangeably.

Relocation of sediment for beneficial purpose during a navigation project is not uncommon. However, existing dredged material management terminology typically describes either the type of discharge operation (e.g., side-cast, bottom-dump, etc.), the discharge location (e.g., nearshore, upland, etc), or the intent of the discharge operation (e.g., beach nourishment, disposal, etc). Alternatively, biologists, ecologists, and resource managers will typically describe beneficial use as an end-purpose (e.g., recreation, reclamation, RSM, habitat, agriculture, etc). Rarely, do the resource manager and the dredging industry describe the same operation using the same terminology. Terminology for dredged material management is needed to include two attributes of the discharge activity: location-specific information (i.e., upland, near-shore, in-water, and ocean); and the intent of the discharge (i.e., disposal or beneficial use). Dredged material terminology that describes both attributes (e.g., nearshore placement for shoreline protection, upland placement for ecological habitat, etc.) will allow the dredging industry to track the volume of sediment used for a beneficial purpose.

In addition, regulations associated with both the Marine Protection Research and Sanctuaries Act (MPRSA) (40 Code of Federal Regulation (CFR) Part 227 and Part 228) and the Clean Water Act (CWA) (40 CFR Part 230), which are the regulating authorities for discharge of dredged material in the aquatic environment, both recognize the intent for discharge. According to the

regulations, dredged material can be discharged with the intent for disposal or discharged with the intent for fill for beneficial purpose. Therefore, using consistent terminology that includes both location-specific and purpose-specific information can prescribe the regulatory program authorizing the activity.

BACKGROUND: Waterborne commerce has been integral to the US economy since the beginning of our nation and continues to be essential for the health and welfare of the United States. Movement of goods via navigation has been an economical and environmentally efficient method since the inception of waterborne transport. The USACE has a mission to maintain the 11,000 miles of commercially important waterways within the United States (USACE 2011) so that navigation channels provide safe and efficient access throughout the nation. Navigation access requires dredging for maintenance and new-work construction. Dredging removes recent sediment deposits for the maintenance of a navigational waterway (maintenance dredging) or long-time natural sediment and rock to create new navigation access (new-work construction). Excavated material will range from large rock to soft mud (composed of sand, silt, clay, water, and organic matter). An average of 220 million cy of dredged material was managed annually between 1995 and 2011 by the fleet of dredges owned and contracted by the USACE (see Figure 1).

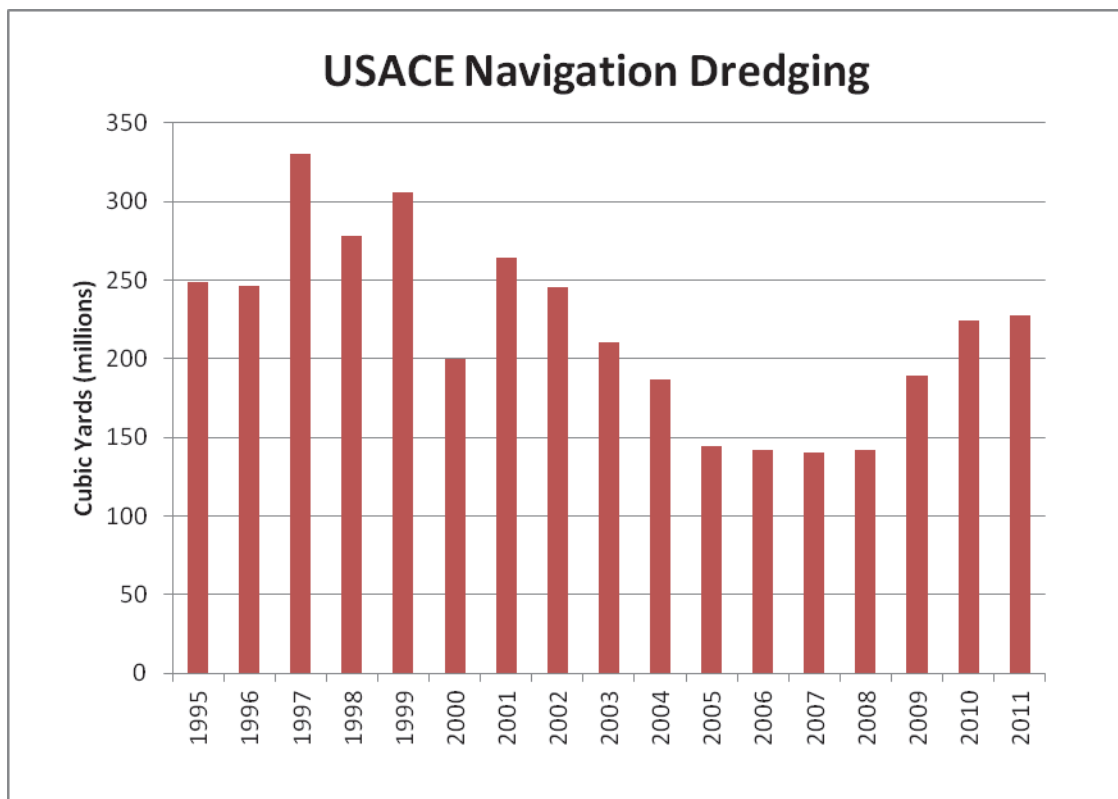


Figure 1. Navigation dredging by Corps-operated dredges and Corps contract dredges between 1995 and 2011 (DIS database 29-Feb-2012 with “actual cy” sorted as preferred volume estimate).

Navigational dredged material is managed with intent: either for disposal; or for beneficial use. Engineer Manual (EM) 1110-2-5026 (USACE 1987) defines beneficial use as using dredged sediments as a resource in a productive way, providing environmental, economic, or social

benefits. Beneficial use of dredged sediments as a first-order management option is optimal due to cost saving and engineering efficiency. That is, beneficial use opportunities at the point of initial discharge will typically be more efficient rather than recycling previously placed dredged sediment. Considering beneficial use of sediments as a dredged material management option during the design of the dredging project will be most efficient.

Beneficial use of dredged material is not a new concept. Historically, dredged material has been beneficially used for over 2500 years on the coasts of Europe and Asia, and in the past 250 years on the coasts, rivers, and lakes of North America (Landin 1997). Navigational projects which include relocation of sediments for the purpose of land development, levee construction, beach nourishment, and island creation commonly occurs.

CURRENT DREDGED MATERIAL MANAGEMENT CATEGORIES: The Dredging Information System (DIS) is a USACE dredging database maintained by IWR that provides information dating back to 1990. The DIS provides the USACE with national awareness of work planned, work accomplished, acquisition strategies, and equipment needs and availability; and provides industry with the knowledge of upcoming work and is a central source of information for briefings (Pankow, 2010). The DIS includes information about the project name and location, type of dredge plant, volume of sediments dredged (estimated quantity and actual quantity), estimated and actual costs, start and stop dates, and type of material disposal. The National Dredging Center compiles the information collected in DIS and provides annual informational reports. Since 2004, the DIS has also maintained dredging data for non-navigational purposes, such as mining sediment for beach nourishment or ecosystem restoration projects. The data entry variable, “DISP_TYPE” (type of material disposal) is entered into DIS as an alpha character representing one of ten categories. However, categories for DISP_TYPE do not differentiate disposal and beneficial use of the dredged sediment. Although DIS is capable of directly tracking beneficial use as a discrete data entry key, traditionally the Districts have not performed the additional data entry. Therefore, demonstrating the volume of sediment used for beneficial purpose becomes a problematical task. The dredged material management categories for both Corps-owned dredges and Corps-contracted dredges, as reported in DIS, are shown in Table 1. Definitions of each category were obtained from the DIS User Guide.

A DIS data file, provided by IWR on 29 February 2012, included data from 1991 through 2011, which was processed (i.e., sorted) using the entry key of “actual cy” as the preferred sorting category to determine the recorded volume of dredged material. Based on the file and the hierarchy for recorded volume, the dredged material management categories and percentages are presented in Figure 2.

Although the information collected in the DIS does not differentiate disposal and beneficial use, it is currently the most comprehensive database to estimate previous beneficial use for maintenance and new work navigational dredging projects performed by USACE-owned dredges as well as USACE-contracted dredges. Using the DIS file provided by IWR on 29 February 2012, the author applied professional judgment to each category and developed an estimated range of dredged sediment that was used for beneficial purpose. These percentages are presented in Table 2. Note that the estimates are approximated and should not be considered exact. Non-navigational dredging (i.e., mined sediment) is not included in the estimate below, although it can be assumed to be 100% beneficially use, as the sediment would not have been relocated

unless the resource was needed. According to DIS records, non-navigational dredging performed by contract dredges ranged from 3% to 17%, with an average of 6% between 2004 and 2011 (USACE 2012a (DIS)). The dredged material management categories presented in this technical note can also be applied toward mined sediment.

Table 1. Dredged material management category as tracked by DIS.		
Tracker (Disp_Type)	Material Management Category	Definition of Material Management Category, according to DIS User Guide
B	Beach nourishment	Beach restoration in which hydraulically pumped dredged material is directly placed onto an eroded beach.
C	Confined	Placement of dredged material within diked nearshore or upland confined placement facilities that enclose and isolate the dredged material from adjacent waters.
D	Underwater confined	Placement of dredged material in an underwater area that is or will be isolated from the overlaying water with a layer of clean material.
M	Mixed, more than one type	Placement or discharge location or combination of locations that is not represented by other categories.
O	Overboard and open water	Placement of dredged material in rivers, lakes, estuaries, or oceans via pipeline or surface release from hopper dredges.
S	Open water and upland	Combination of open-water and upland placement of material from a single dredging project, when volumes are not clearly separable.
T	Beach nourishment and upland	Combination of beach nourishment and upland placement of material from a single dredging project, when volumes are not clearly separable.
U	Upland	Placement of dredged material on land above adjacent water surface elevation.
W	Wetlands nourishment or creation	Wetland restoration in which hydraulically pumped dredged material is directly placed in a wetland area.
X	Undefined	Any method or combination of disposal methods not otherwise defined.

The estimated range of beneficial use (33-73%) represents a substantial amount of sediments dredged within the Navigation Mission of the USACE. The range of the estimate is significant and can be used as justification to begin more rigorous tracking. Consistent dredged material management categories should differentiate disposal and beneficial use.

SURVEY OF DREDGED MATERIAL MANAGEMENT CATEGORIES: A questionnaire survey with proposed dredged material management categories was sent to forty-two recipients including the USACE Strategic Navigation Action Team (SNAT), division navigation managers, and several district navigation managers. The questionnaire survey included questions about tracking dredged material management, the number of placement sites typically available for each project, and if beneficial use was considered a dredged material management strategy or a secondary re-use of sediment. Twelve responses were received.

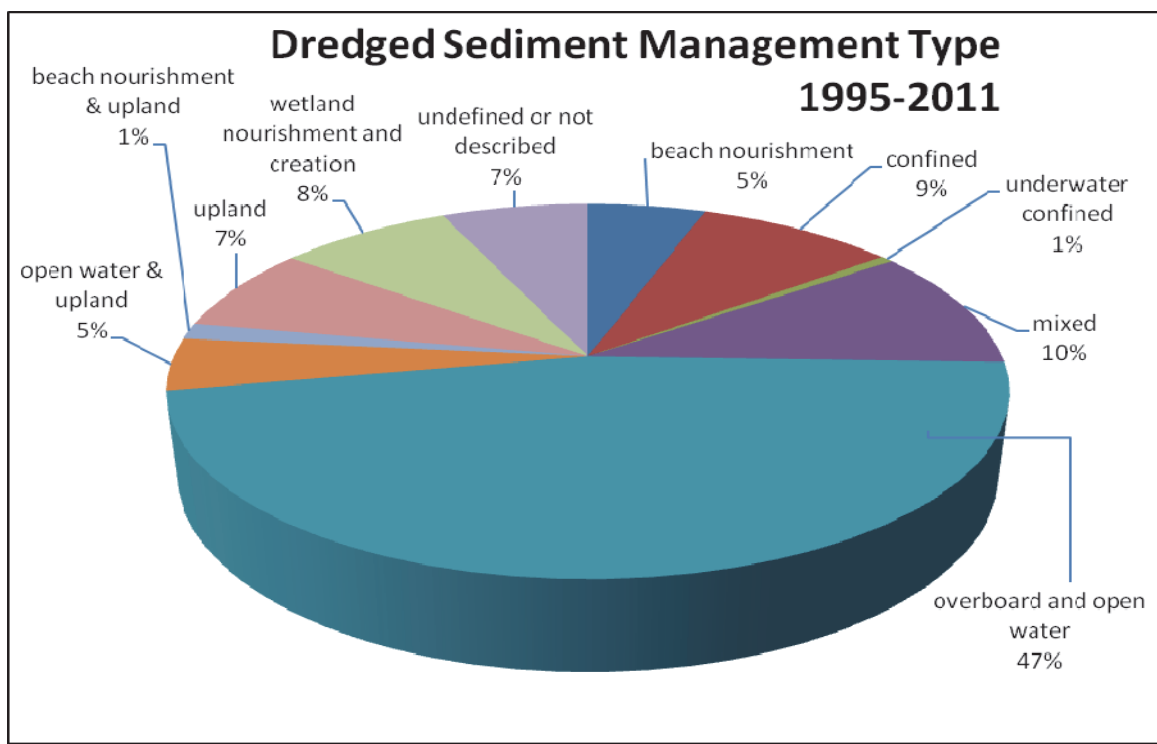


Figure 2. Navigation dredging by Corps-operated dredges and Corps contract dredges between Fiscal Years 1995 and 2011 (DIS database 29 February 2012 with “actual cy” sorted as preferred volume estimate).

Table 2. Dredged material management category as tracked by DIS (DIS database 29February2012), with estimates of beneficial use.

Tracker (Disp_Type)	Material Management Category	Percentage of Total Dredged Material Management from 1995 to 2011	Estimated Percent of Dredged Material Potentially Used Beneficially
B	Beach nourishment	5	5
C	Confined	9	1-5
D	Underwater confined	1	0-1
M	Mixed, more than one type	10	4-8
O	Overboard and open water	47	10-30
S	Open water and upland	5	1-5
T	Beach nourishment and upland	1	1
U	Upland	7	1-5
W	Wetlands nourishment or creation	8	8
X	Undefined	7	2-5
Total		100	33-73

Each respondent considers beneficial use as a dredged material management alternative, rather than a re-use option. This is an important clarification and is justification that terminology for dredged material management should include the distinction between disposal and beneficial use. If navigation managers view dredged material management as a simple act of disposal, the

current categories would be sufficient. Instead, navigation managers are actively considering various dredged material management alternatives, including beneficial use. Most respondents agreed that a better tracking system at the project level would be valuable; and less, but still the majority, indicated tracking at the national level is needed or would be useful for an understanding of other District practices or national trends. Regarding the number of available placement sites per project: each respondent indicated the number of placement site alternatives are limited to between 1 and 3. Comments indicated there were concerns about the “overlap of categories.” For example, sediment may be dredged and relocated from the navigation channel to a wetland nourishment project, but could also be considered shoreline protection. Another example was relocation for beach nourishment, which could also be habitat for sea turtles. Based on the responses, one category was expanded and two categories were further defined. The revised dredged material management categories are presented below.

DREDGED MATERIAL MANAGEMENT CATEGORIES: In 1987, a national workshop was held for beneficial use of dredged material in inland waterways (Landin 1988). The national workshop included the USACE-HQ Dredging Division Chief (Bill Murden), various district personnel, USACE Researchers, U.S. Environmental Protection Agency (USEPA), Environment Canada, federal and state resource agencies, and academia. This workshop emphasized the importance of continuity between navigational dredging and the relocation of sediment for beneficial purpose. Projects in need of sediment will benefit from navigation dredging projects; and, sustainable navigation is dependent on finding cost-efficient opportunities for beneficial use of the dredged sediment. Today’s navigation managers clearly consider beneficial use of sediment as a dredged material management alternative based on responses from the questionnaire survey. However, consistent dredged material management terminology which differentiates disposal from beneficial use is not yet available. The USACE and others in the dredging industry have many examples of successful projects that have relocated sediment for beneficial purpose, yet an accurate account is not currently available. Terminology that differentiates disposal of dredged sediment from the beneficial use of dredged sediment is obviously needed.

The proposed following are 12 categories of dredged material (DM) management:

1. **Placement for Upland Land Development:** DM placed for upland elevation gain or land development including commercial, agriculture, and parks and recreation. This option also includes side casting for dike or levee construction; and land development of a Confined Disposal Facility (CDF).
2. **Upland Placement for Ecological Habitat:** DM placed for upland habitat such as upland forest or bird habitat. This option also includes transition of upland CDF for habitat.
3. **Upland Placement for Soil Reuse:** DM placed for reuse, such as upland CDF with the intention of reusing a portion of the dredged sediment for beneficial purpose (e.g., rehandling for landfill cover, mine reclamation, construction fill, etc.)
4. **Upland Disposal:** DM placed in an up-land CDF for disposal with no intention of present or future beneficial purpose. This option includes rehandling for disposal into a landfill, but does not include reclamation uses, such as daily landfill cover.

5. **Beach or Nearshore Placement for Shoreline Protection or Beach Nourishment:** placement of DM on or along the shoreline (coastal, estuary, and inland), including stable or feeder berms. This option includes sediment placed directly for beach nourishment, as well as nearshore with the intent for the dredged material to remain within the depth of closure or littoral zone.
6. **Shallow water placement for Wetland, Marsh, or Habitat:** Dredged material placed below ordinary high water for wetland or marsh nourishment/creation or other habitat such as bottomland hardwood, salt marsh, swamp, wooded wetland, scrub-shrub, and forested wetland. Benefits can also include storm and surge protection.
7. **Unconfined aquatic placement (River, Lake, Estuary, and Ocean):** Dredged material placed into a river, lake, bay, estuary, or territorial sea, including flow lane placement, side-casting, agitation dredging, and other unconfined in-water placement. Maintaining sediment in the littoral system of the watershed is considered beneficial to the aquatic ecosystem and RSM.
8. **Confined in-water placement for beneficial purpose:** In water placement confined to a defined footprint such as a nearshore CDF or confined aquatic disposal (CAD) that will support sub-aquatic vegetation, essential fish habitat, or other beneficial purpose. This option includes aquatic placement into an aquatic transfer facility (ATF) for future rehandling or transfer.
9. **Confined in-water disposal:** In water disposal confined to a defined footprint; such as a nearshore CDF or CAD with no present or future intent of beneficial purpose.
10. **Island Placement for Benefits:** dredged material placed for island creation or island nourishment, including levees. Also included in this option are other categories that apply specifically to island placement such as upland habitat, beach nourishment, nearshore habitat, etc. Does not include disposal, which is different category.
11. **Ocean Placement for Beneficial Use:** Ocean placement of dredged material into a designated Marine Protection, Research, and Sanctuaries Act (MPRSA) Site, intended for a beneficial purpose.
12. **Ocean Disposal:** Ocean placement of dredged material into designated MPRSA Site, intended for disposal.

Note that in general, each category includes information regarding the *location* with respect to the water elevation, as well as the *intent* of discharge (disposal or beneficial use). Consistent terminology that combines location-specific management (where) and purpose-specific management (why) will assist with accurate tracking. The intent of disposal is incorporated into three categories (upland, inland waters, and ocean waters). The intent of beneficial use is incorporated into the remaining nine categories. Management of dredged sediment in the aquatic environment for beneficial purpose is incorporated into six of the nine categories, with the remaining three categories for upland (above ordinary high water) management. The use of agreed-upon nomenclature describing dredged material management, specific to beneficial use, will reduce confusion and establish a uniform set of terms that can be applied in most all cases. The dredged material management categories presented in the technical note can also be applied toward mined sediment as well.

TRACKING DREDGED MATERIAL MANAGEMENT AND BENEFICIAL USE: The USACE maintains several databases associated with dredging and dredging contracts, including the CE-Dredge database, the Resident Management System (RMS) database, the Dredging Quality Management (DQM) database, and the Dredging Information System (DIS). The Navigation and Coastal Data Bank (NCDB) consolidates and populates priority USACE data, including dredged material placement sites within the coastal districts, into an enterprise Geographic Information System database. The dredged material management categories presented in this technical note are currently being integrated into the DQM database as a descriptor for dredged material management.

ADDITIONAL INFORMATION: This technical note was prepared by John L. Childs, research civil engineer, Environmental Laboratory, U.S. Army Engineer Research and Development Center. The study was conducted as an activity of the Dredging Operations and Environmental Research (DOER) Program. For information on DOER, please consult <http://el.erdc.usace.army.mil/dots/doer> or contact the Program Manager, Dr. Todd S. Bridges, at Todd.S.Bridges@usace.army.mil. This technical note should be cited as follows:

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